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➤ **Introduction:** EETAC is a high ranked aeronautical institute, which is participating in several international contests. It has actually four space programs:

- Wikisat : a 20 grams femto satellite to win the N-prize
- Wikilauncher : a micro launcher less than 100 kilograms
- Picorover to the moon: a minimal mission to win the X-prize
- Ultra mini launcher: a mini launcher less than 1000 kilograms

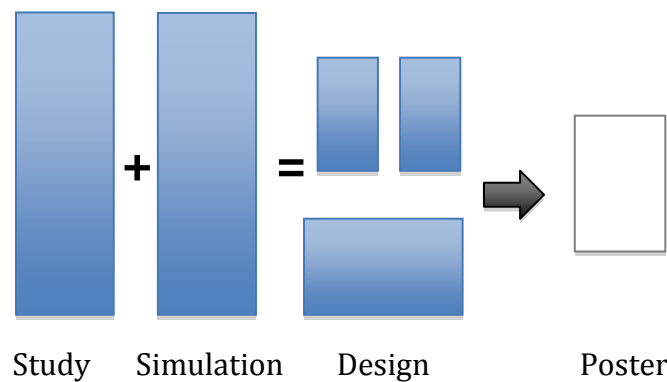
The laboratory in charge with these programs requires to make several simulations and experiments on these machines. One of the main tasks is to check the aerodynamical parameters. To do so, the lab has developed and created wind tunnels but only for subsonic speeds. We were requested by the laboratory to design and create a supersonic wind tunnel, which they were missing.

➤ **Preliminary study:**

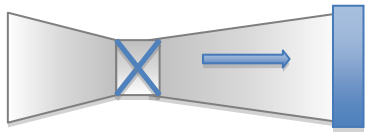
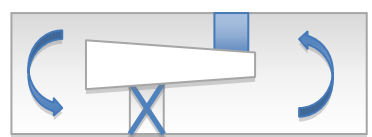

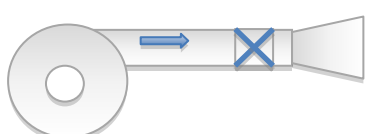
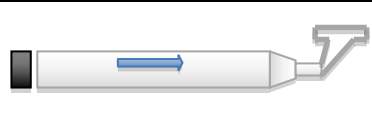
Planning

M	T	W	T	F
5	6	7	8	9
Preliminary Study				
12	13	14	15	16
Study Simulation				
19	20	21	22	23
Design				
26	27	28	29	30
Poster A3				

Design Stages



Type of SuperSonic Wind Tunnel

Open Circuit	
Closed Circuit	
Blow Down	
Blower Tunnel	
Explosive Tunnel	

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➤ **First result:** After our preliminary study, we found that it will be better to know the flow inside the rocket instead of outside. So we had to reconsider our whole study.

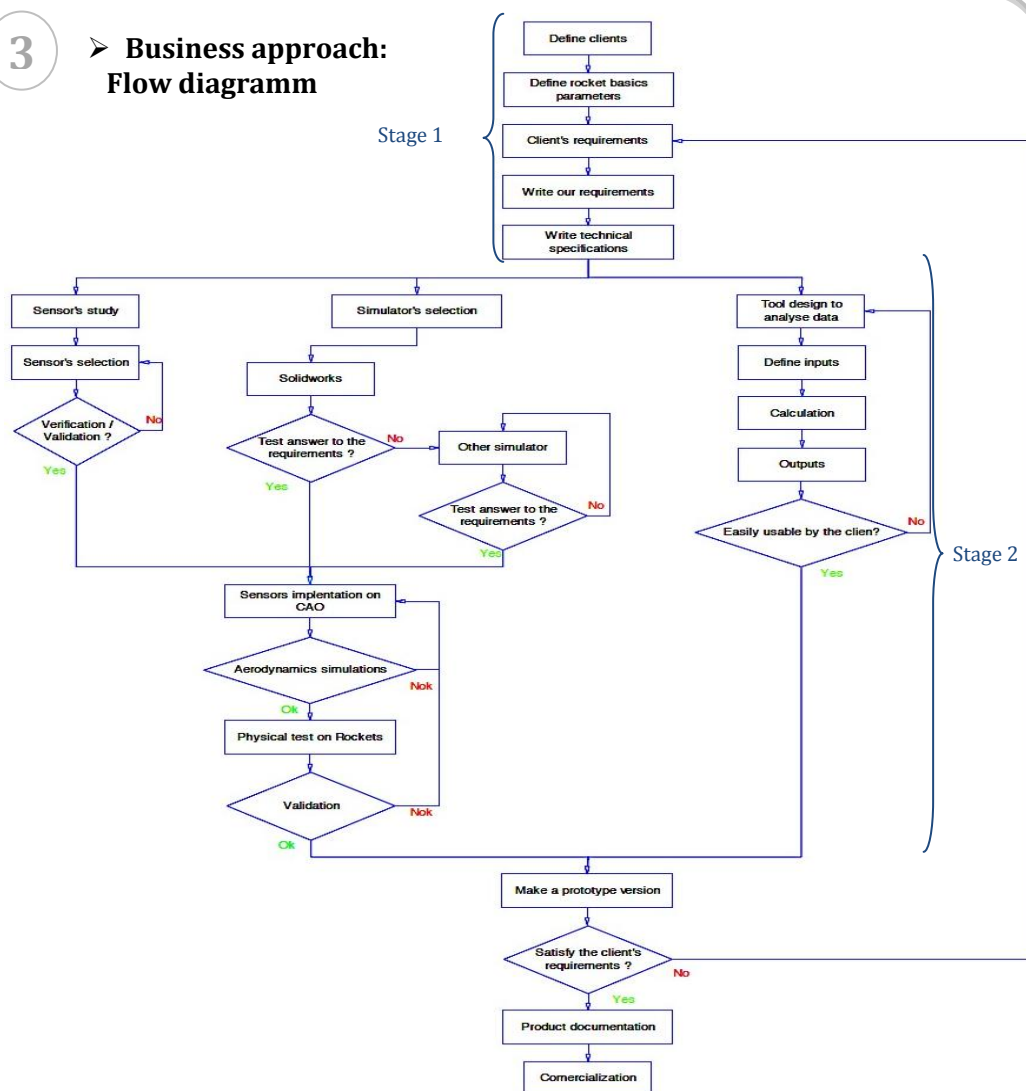
2 options were possible:

- Keep our research and design a wind tunnel, change the application for aircraft.
- Or change the meaning of wind tunnel and think about how to measure the flow inside the rocket.

We choose the second solution; it seemed more interesting because, this system doesn't exist so we have to start from scratch and because it is very complicated to make a vacuum wind tunnel.

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Business approach: Flow diagramm



➤ Business approach: Tasks explanations:

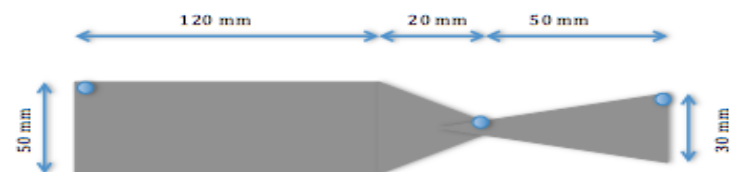
In the first stage, we have to study and define the market: what customer? (NASA, CNES, Amateurs...) what rockets? (Size, speed, propellant...). We have to define our requirements: what measures, data? and those of the clients to propose them to know news information to improve their engines.

In the second stage, the goal is to develop our product. We split this part into three parts: sensors study, simulator study and analysis tool.

At the end, this project will provide a business plan, a technical specification, a design document, a validation plan and a requirements document.

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➤ Study case of the 2nd stage Wikisat launcher:



➤ Sensors study and selection:

2 options:

- Bench tests: enables a bigger variety of sensors and of tests.
- Real flight tests: is more constraining as far as the quantity of tools that can be used is concerned.

Requirements:

- Accurate data
- Range temperature above 600°C
- Avoid using analogue device
- Avoid using more than one regulator
- Use a common voltage of 3,7V for all the equipment (Li Poly battery)
- The lightest sensors and equipments

The most important difference between those 2 options is that one of them will be launch in the space. So the system must be efficient in space. And one other important point is that we have to send the data from space to Earth because it will never come back.

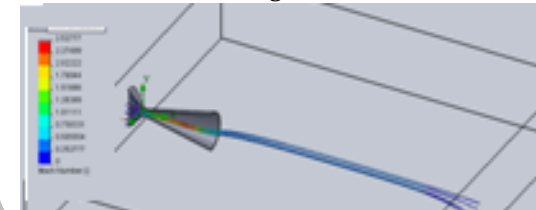
Implementing the rocket with the sensors is first to be done on a test bench, which can offer a preview of how will be the results in the space. This first test isn't as restrictive as the real one, so we will use more technologies that are not matching our real flight requirements

➤ Solidwork® simulation:

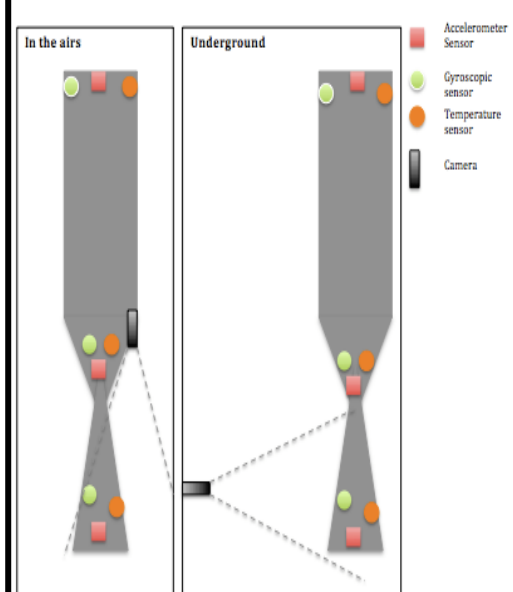
Solidworks® is a tool used by professionals all over the world. In fact, it is easier to handle as other CAO soft ware.

Basically, the main job to be done was to create the model which will be used, and to create a flow in it. The tool is then able to simulate the flight, as it should happen in real conditions.

The purpose of the whole study is to go in the opposite direction by verifying this simulation with the results coming from our sensors.



➤ Sensors implantation:



➤ **Conclusion:** This study was a preliminary work of how to implement a rocket with sensors in order to get information about the flight. The development plan is established and should allow the Wikisat team to be guided for its upcoming work.

The next stage is to take the results of the simulations realized on Solidworks® and consequently, implement the rocket with the well defined sensors. Nevertheless, there is still a problem to solve as far as the emitter, which is supposed to send the data on the Earth, is concerned.